## Lesson 8: Reasoning about Solving Equations (Part 2)

Let’s use hangers to understand two different ways of solving equations with parentheses.

### 8.1: Equivalent to $2\left(x+3\right)$

Select **all** the expressions equivalent to $2\left(x+3\right)$.

1. $2⋅\left(x+3\right)$
2. $\left(x+3\right)2$
3. $2⋅x+2⋅3$
4. $2⋅x+3$
5. $\left(2⋅x\right)+3$
6. $\left(2+x\right)3$

### 8.2: Either Or

1. Explain why either of these equations could represent this hanger:
* 
* $14=2\left(x+3\right)$ or $14=2x+6$
1. Find the weight of one circle. Be prepared to explain your reasoning.

### 8.3: Use Hangers to Understand Equation Solving, Again

Here are some balanced hangers. Each piece is labeled with its weight.



For each diagram:

1. Assign one of these equations to each hanger:
* $2\left(x+5\right)=16$
* $3\left(y+200\right)=3​,000$
* $20.8=4\left(z+1.1\right)$
* $\frac{20}{3}=2\left(w+\frac{2}{3}\right)$
1. Explain how to figure out the weight of a piece labeled with a letter by reasoning about the diagram.
2. Explain how to figure out the weight of a piece labeled with a letter by reasoning about the equation.

### Lesson 8 Summary

The balanced hanger shows 3 equal, unknown weights and 3 2-unit weights on the left and an 18-unit weight on the right.

There are 3 unknown weights plus 6 units of weight on the left. We could represent this balanced hanger with an equation and solve the equation the same way we did before.

$\begin{matrix}3x+6&=18\\3x&=12\\x&=4\end{matrix}$



Since there are 3 groups of $x+2$ on the left, we could represent this hanger with a different equation: $3\left(x+2\right)=18$.



The two sides of the hanger balance with these weights: 3 groups of $x+2$ on one side, and 18, or 3 groups of 6, on the other side.



The two sides of the hanger will balance with $\frac{1}{3}$ of the weight on each side: $\frac{1}{3}⋅3\left(x+2\right)=\frac{1}{3}⋅18$.



We can remove 2 units of weight from each side, and the hanger will stay balanced. This is the same as subtracting 2 from each side of the equation.



An equation for the new balanced hanger is $x=4$. This gives the solution to the original equation.



Here is a concise way to write the steps above:

$\begin{matrix}3\left(x+2\right)&=18&\\x+2&=6&after multiplying each side by \frac{1}{3}\\x&=4&after subtracting 2 from each side\end{matrix}$



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